Homework 4

COMP 575/770 Spring 2016

Due: March 2, 2016 (in Class)

Instructions Please work on the problems on your own. It is okay to discuss the problems with other students, but please write your answer independently. If you are able to find any part of the solution in a book or some source on the Internet, please acknowledge that source.

Commutativity of Transforms For two 3D transformations $\mathbf{A}$ and $\mathbf{B}$, we say $\mathbf{A}$ and $\mathbf{B}$ are commutative if $\mathbf{AB} = \mathbf{BA}$. Consider the following three 3D transformations:

- Rotation $\mathbf{R}$ which transforms the $+x$ axis to $+y$, $+y$ to $+z$, and $+z$ to $+x$.

- Scale $\mathbf{S}$ which scales along x, y, and z axes by factors 2, 3, and 4, respectively.

- Translation $\mathbf{T}$ which moves along x, y, and z axes by 3, 2, and 1 units, respectively.

Questions

1. Write $\mathbf{R}$, $\mathbf{S}$, and $\mathbf{T}$ as 4×4 homogeneous matrices.

2. Compute the compositions $\mathbf{RS}$, $\mathbf{SR}$, $\mathbf{ST}$, $\mathbf{TS}$, $\mathbf{TR}$, and $\mathbf{RT}$. Are $\mathbf{R}$ and $\mathbf{S}$ commutative? How about $\mathbf{S}$ and $\mathbf{T}$? $\mathbf{T}$ and $\mathbf{R}$?

3. Fill in the following table with the commutativity of transformations in general. For example, if any rotation is commutative with any translation, write "yes" in row 1, column 3; otherwise, write "no". The darkened cells do not need to be filled in.

	Rotation	Scale	Translation
Rotation			
Scale			
Translation			